CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION
PUBLIC REPORT 2007-10

Active Ingredient: Spinetoram
Tracking ID Numbers 218411, 218412, 218413, 218414, 218415

DESCRIPTION OF ACTION

Dow AgroSciences LLC submitted applications to the Department of Pesticide Regulation (DPR) for California registration of five products: Spinetoram Technical, EPA Reg. No. 62719-539, Delegate WG, EPA Reg. No. 62719-541, GF-1640 WG-NC, EPA Reg. No. 62719-540, Radiant SC, EPA Reg. No. 62719-545, and GF-1587 SC-NC, EPA Reg. No. 62719-544. The five products contain the new pesticide active ingredient spinetoram. Spinetoram is not found in any pesticide product previously registered in the United States. Spinetoram is a broad-spectrum insecticide intended for use on a wide range of fruits and vegetable crops. Dow AgroSciences LLC requested that DPR accept its applications for registration of the five products concurrently with submission of Dow AgroSciences LLC's applications to the U.S. Environmental Protection Agency (U.S. EPA) for federal registration. California Food and Agricultural Code section 12836.5 requires DPR to accept an application for registration of a pesticide product containing a new active ingredient concurrently with the applicant's submission of its application to the U.S. EPA for federal registration.

On September 28, 2007, the U.S. EPA granted full registration for Spinetoram Technical and conditional registration for Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC. Under the federal conditions of registration for the four products, U.S. EPA required Dow AgroSciences LLC to make a number of labeling changes and submit additional data . The labeling changes, which included a number of revisions to the Directions for Use and Environmental Hazards sections of the product labels, have been incorporated into the labels submitted to DPR.

The U.S EPA conditions of registration require submission of the following data:

- Residue chemistry data:

Guideline reference No.	Study title	Due date
OPPTS 860.1340	Successful PMV of plant and livestock enforcement methods	March 28, 2008
OPPTS 860.1480	Poultry feeding study	March 28, 2009
OPPTS 860.1520	Processing studies	September 28, 2009
Non-Guideline	Analytical reference standards	March 28, 2008

- A one year storage stability test, conducted concurrently with the corrosion characteristics study at 0, 3, 6, 9, and 12 months of warehouse storage.

- Ecological effects data:

Guideline Reference No.	Study Title	Due Date
72-2	Acute freshwater invertebrate	June 28, 2008
OPPTS 850.1025	Oyster acute toxicity test (shell deposition) raw data or new study	June 28, 2008
72-3a	Acute estuarine/marine fish	September 28, 2009
72-3b	Acute freshwater fish	September 28, 2009
72-4c	Mysid chronic toxicity test	February 28, 2009
OPPTS 850.1735	Whole sediment acute toxicity invertebrates, freshwater	February 28, 2009
OPPTS 850.1740	Whole sediment acute toxicity invertebrates, estuarine	February 28, 2009
OPPTS 850.3030	Honey bee toxicity of residues on foliage	February 28, 2009

DPR evaluated the product labels and submitted data for the five spinetoram products and found them acceptable to support registration. Precautionary and first aid statements and other protective measures on the product label adequately mitigate the potential health risks to users. The data adequately substantiates Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC as effective broad- spectrum insecticides. DPR does not expect significant adverse environmental impacts to result from registration of the five products.

BACKGROUND

Registrant: Dow AgroSciences LLC.
Common name: Spinetoram
Chemical name: J-isomer: (2S,3aR,5aS,5bS,9S,13S,14R,16aS,16bS)-13-{[(2S,5S,6R)-5-(dimethylamino)-6-methyltetrahydro-2H-pyran-2-y1]oxy}-9-ethyl-4,14-dimethyl-7,15-dioxo-2,3,3a,5a,5b,6,7,9,10,11,12,13,14,15,16a,16b-hexadecahydro-1H-as-indaceno[3,2-d]oxacyclododecin-2-y1-6-deoxy-3-O-ethyl-2,4-di-O-methyl-beta-L-mannopyronoside
L-isomer: (2R,3aR,5aR,5bS,9S,13S,14R,16aS,16bR)-13-{[(2S,5S,6R)-5-(dimethylamino)-6-methyltetrahydro-2H-pyran-2-y1]oxy}-9-ethyl-14-methyl-7,15-dioxo-2,3,3a,4,5,5a,5b,6,7,9,10,11,12,13,14,15,16a,16b-octadecahydro-1H-as-indaceno[3,2-d]oxacyclododecin-2-y1-6-deoxy-3-O-ethyl-2,4-di-O-methyl-beta-L-mannopyronoside
Brand name: Delegate WG, GF-1640 WG-NC, Radiant SC, GF-1587 SC-NC and Spinetoram Technical
Uses: Insecticide
Pests controlled: Lepidopterous larvae, diptera, and leaf feeding beetles

Type of registration: Full Registration

The products Delegate WG and GF-1640 WG-NC are identical in formulation. Both are water dispersible granular formulations containing 25% spinetoram. Radiant SC and GF-1587 SC-NC are also identical in formulation. Both products are formulated as a liquid suspension containing 11.7% spinetoram. Spinetoram Technical contains 86.4% spinetoram, and is labeled for manufacturing use only. Delegate WG and Radiant SC are labeled for agricultural use, and GF-1640 WG-NC and 1587 SC-NC are labeled for commercial and residential uses.

Spinetoram belongs to the spinosad chemical class of insecticides, and is classified as a reduced risk chemical by the U.S. EPA. Spinetoram is a fermentation metabolite of the naturally occurring soil actinobacteria *Saccharopolyspora spinosa*. Spinetoram kills susceptible insect species by causing rapid excitation of the insect nervous system. Spinetoram controls a wide variety of insect pests, including fruit flies, caterpillars, leafminers, thrips, sawflies, and leaf beetles. The Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC labels recommend use of the products as a part of an integrated pest management (IPM) program.

SCIENTIFIC REVIEW

A. Chemistry

Dow AgroSciences LLC submitted chemistry studies for Spinetoram Technical, Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC. DPR evaluated the studies and determined that the submitted product chemistry and environmental fate data support registration of the five products. Dow AgroSciences LLC did not submit data addressing residue in food and animal feed. In accordance with California Notice 2004-7, DPR no longer requires these data.

1. Product Chemistry**:** The product chemistry results are summarized in Table 1 on page 4.

2. Environmental Fate**:** The spinetoram environmental fate data were derived from Spinetoram Technical. The studies included hydrolysis, aquatic photolysis, soil photolysis, aerobic soil metabolism, aerobic aquatic metabolism, and field dissipation. DPR initially determined that the aquatic photolysis and field dissipation studies were incomplete. Dow AgroSciences LLC provided the data required to complete the studies and DPR found the upgraded studies to be satisfactory. However, when compared with the U.S. EPA and California EPA criteria for predicting the potential of a chemical to reach ground water, the submitted studies indicated that spinetoram has the potential to leach, as summarized in Table 2 on page 5.

   Due to the potential environmental concerns noted in Table 2, the five products were routed to the Environmental Monitoring Branch (EM) for review. The four end-use products are labeled for foliar application at the low maximum application rate of 1.75 ounces of active ingredient per acre. During its review, EM noted that pesticides with only foliar applications have not been detected in ground water and present a very low potential to leach. Delegate

WG and Radiant SC labels recommend applications via chemigation through overhead sprinkling systems. However, the labels list micro-sprinklers as one of the approved chemigation systems. Micro-sprinklers are designed to provide irrigation water underneath the plant foliage directly onto the soil. Consequently, the application of Delegate WG and Radiant SC directly to the soil by a micro-sprinkler system would provide the potential for spinetoram to leach to ground water. Dow AgroSciences LLC has agreed to remove the micro-sprinkler system use from the Delegate WG and Radiant SC labels at its next label printing. EM determined that deleting the micro-sprinkler systems application method from the labels at the next printing is acceptable. This action further minimizes the possibility that spinetoram will leach to ground water. The submitted product chemistry, residue chemistry, and environmental fate data support registration of Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC.

Table 1. Physical and Chemical Properties of Technical Spinetoram

Properties	Values
Physical state	Off-white solid
Bulk density	0.24 grams (g)/centimeter^3 (cm)
pH (1% solution)	6.5
Melting point	143 °C
Partition coefficient (K_{ow})	J-isomer pH 5: 2.75 x 10^2 (Log K_{ow} = 2.44) pH 7: 1.23 x 10^4 (Log K_{ow} = 4.09) pH 9: 1.66 x 10^4 (Log K_{ow} = 4.22) L-isomer pH 5: 8.71 x 10^2 (Log K_{ow} = 2.94) pH 7: 3.09 x 10^4 (Log K_{ow} = 4.49) pH 9: 6.61 x 10^4 (Log K_{ow} = 4.82)
Solubility	Soluble in methanol, acetone, ethyl acetate
Vapor pressure	J-isomer 4.0 x 10^{-7} mm Hg L-isomer 1.6 x 10^{-7} mm Hg
Dissociation constant	J-isomer pKa 7.9 L-isomer pKa 7.6
Storage stability and corrosion	GF-1587 and GF-1640 were stable and non-corrosive in foil laminate packaging for one year at ambient temperature

Table 2. Comparison of U.S. EPA and Cal/EPA Ground Water Leaching Criteria with Environmental Fate Study Results for Spinetoram

Parameter	Potential to Leach Value (U.S. EPA)	Potential to Leach Value (Cal/EPA)	Experimental Value	Criteria Exceeded
Water solubility	> 30 ppm	> 3 ppm	J-isomer 11.3 ppm L-isomer 46.7 ppm	Yes
Soil adsorption coefficient (K_d)	< 5 ml/g		12 – 483	No
K_{oc}		<1,900 ml/g	J-isomer 1800 ml/gm L-isomer 43900 ml/gm	Yes
Hydrolytic half-life	> 30 days	> 14 days	Stable	Yes
Photolytic half-life	> 7 days		J-isomer 0.3 days L-isomer 116 days	Yes
Anaerobic soil metabolic half-life	> 21 days	> 9 days	Stable	Yes
Aerobic soil metabolic half-life	> 21 days	> 610 days	15 days (loamy sand) 6.4-8.7 days (sandy loam) 9.9 days (sand)	No
Field dissipation half-life	> 21 days		1-5 days	No

B. Toxicology

Dow AgroSciences LLC submitted adequate toxicology studies to conduct complete toxicological evaluations of the five spinetoram products. DPR evaluated the submitted data to determine the potential for adverse health effects. The product labels adequately identify the potential acute toxicity hazards indicated by the data reviewed. The first aid statements and personal protective equipment (PPE) requirements are adequate for the indicated acute toxicity hazards. The acute toxicity parameters for spinetoram, are summarized in Table 3 on page 6.

Table 3. Summary of Acute Toxicity of Spinetoram Technical		
Type of Study	**Acute Toxicity Values***	**Acute Toxicity Category**
Acute oral	LD_{50} > 5000 mg/kg	IV
Acute dermal	LD_{50} > 5000 mg/kg	IV
Acute inhalation	LC_{50} > 5.50 mg/l	IV
Primary eye irritation	N/A	IV
Primary dermal irritation	N/A	IV
Acute neurotoxicity	NOEL 2000 mg/kg	No adverse effects
Dermal sensitization	N/A	Dermal sensitizer
Signal word	N/A	CAUTION

*Acute Toxicity Values expressed as:
LD_{50} = Lethal dose that kills 50% of the test population
LC_{50} = Lethal environmental concentration that kills 50% of the test population
N/A = Not applicable

DPR initially found that the submitted toxicology studies for spinetoram were not acceptable to satisfy the data requirements of the Birth Defects Prevention Act (Food and Agricultural Code section 13121, et al.). The required rat combined chronic toxicity and oncogenicity and mouse oncogenicity studies had not been submitted. Dow AgroSciences LLC then provided the required studies and DPR found the submitted toxicology studies for spinetoram sufficient to satisfy the data requirements of the Birth Defects Prevention Act. DPR prioritizes pesticide active ingredients for risk assessment based on of the nature the potential adverse health effects, the number of potential adverse effects, the number of species affected, no observable effect levels (NOELs), the potential for human exposure, use patterns, and other similar factors. Based on these criteria, pesticides with the greatest potential for health problems are placed in high priority, with other chemicals being in moderate or low priority. At this time, DPR has not prioritized spinetoram for risk assessment. The purpose of the risk assessment would be to appraise the potential for spinetoram to cause adverse health effects in humans if exposed to the pesticide through legal use. A summary of toxicology data with the additional spinetoram toxicity information is pending completion. Upon completion, it will be available on the DPR public website at: http://www.cdpr.ca.gov/docs/risk/toxsums/toxsumlist.htm.

C. Health & Safety

DPR's evaluation of the medical management information on the Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC labels and the acute toxicity study results indicate that the product labels bear all of the required statements and warnings regarding safety to handlers and other persons who may be exposed to the pesticide. The product labels bears adequate First Aid statements. In addition, the product labels requires handlers to wash after handling and before eating, drinking, chewing gum, using tobacco or using the toilet.

D. Fish & Wildlife

The registrant submitted fish and wildlife toxicity studies, including studies on *Daphnia magna*, eastern oyster, mysid shrimp, midge, rainbow trout, bluegill sunfish, flathead minnow, sheepshead minnow, earthworm, bobwhite quail, mallard duck, and honeybee. The submitted data are adequate to characterize the toxicity to wildlife and aquatic animals from an environmental exposure**.** The results of these studies are summarized in Table 4 on page 8.

The data indicate that spinetoram is relatively non-toxic to birds and earthworms, moderately toxic to fish and *Daphnia magna*, and highly toxic to mollusks, mysid shrimp, and honeybees. To mitigate the hazards to bees and aquatic organisms, the Environmental Hazards statements on the Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC labels contain the following statement:

- This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.

- This product is toxic to aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash waters. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Apply this product only as specified on the label.

When used as directed, DPR does not expect spinetoram to be released into soil or waterways.

Table 4. Summary of Fish & Wildlife Toxicity Values*

Test Animal	Type of Study	Acute Toxicity Value**	Relative Toxicity
Daphnia magna	Water exposure (48 hrs)	>3.17 mg/l EC_{50}	Moderately toxic
Daphnia magna	Chronic toxicity (21 day)	>0.951 µg/l EC_{50}	N/A
Eastern oyster	Water exposure (96 hrs)	0.393 mg/l EC_{50}	Highly toxic
Mysid shrimp	Water exposure (96 hrs)	0.355 mg/l LC_{50}	Highly toxic
Mysid shrimp	Life-cycle toxicity (28 day)	0.193 mg/l LC_{50}	N/A
Midge	Chronic toxicity (28 day)	97.2 µg/kg NOEC 171 µg/kg LOEC	N/A
Rainbow trout	Water exposure (96 hrs)	>3.46 mg/l LC_{50} 3.46 mg/l NOEC	Moderately toxic
Bluegill sunfish	Water exposure (96 hrs)	2.69 mg/l LC_{50}	Moderately toxic
Fathead minnow	Life-stage toxicity (28 day)	0.977 mg/l LC_{50}	N/A
Sheepshead minnow	Life-stage toxicity (28 day)	1.53 mg/l NOEC >1.53 mg/l LOEC	N/A
Earthworm	Soil exposure (14 day)	>1000 ppm LC_{50} 1000 ppm NOEC	Relatively non-toxic
Bobwhite quail	Acute oral dose	>2250 mg/kg LD_{50}	Relatively non-toxic
Bobwhite quail	Feeding (14 day)	>5620 ppm LC_{50} 1780 ppm NOEC	Relatively non-toxic
Bobwhite quail	Reproduction study (20 weeks)	1000 ppm NOEC	N/A
Mallard duck	Feeding (8 day)	>5620 ppm LC_{50} 1780 ppm NOEC	Relatively non-toxic
Mallard duck	Reproduction study (20 weeks)	1000 ppm NOEC	N/A
Honeybee	Acute contact toxicity (48 hrs)	0.024 µg/bee LD_{50} 0.0065 µg/bee NOEC	Highly toxic
Honeybee	Acute oral toxicity (48 hrs)	0.14 µg/bee LD_{50}	Highly toxic

* The test substance used for the studies was the technical active ingredient.
** Acute Toxicity Values expressed as:
LD_{50} = Lethal dose that kills 50% of the test population
LC_{50} = Lethal environmental concentration that kills 50% of the test population
EC_{50} = Concentration of a toxicant causing a defined non-lethal effect in 50% of the test population
NOEC = No observed effect concentration
LOEC = Lowest observed effect concentration

E. Efficacy & Phytotoxicity

The products Delegate WG and Radiant SC are labeled for agriculture use. The labels for both products contain the same claims, and are intended for use on a wide range of crops, including bulb vegetables, fruiting vegetables, bushberries, cereal grains, grapes pome fruits, stone fruits, soybeans, pistachios, strawberries, and potatoes. The pests controlled or suppressed include lepidopterous larvae, dipterous leafminers, thrips, and leaf-feeding beetles. The Delegate WG and Radiant SC labels recommend application rates ranging from 0.117 to 1.75 ounces active ingredient per acre. Delegate WG and Radiant SC are both labeled for ground row crop application, ground orchard spraying, aerial application, and application by chemigation. Application by chemigation is restricted to overhead sprinkler systems and for use on corn, cranberry, and potatoes.

GR-1640 WG-NC and GR-1587 SC-NC are both labeled for commercial and a residential use. They each contain two supplemental labels, one for commercial use and one for residential use. The labels for commercial uses bear claims for control or suppression of lepidopterous larvae, dipterous leafminers, thrips, sawfly larvae, and certain leaf-feeding beetles in commercial aquatic plants, ornamentals, tree farms or plantations, turfgrass, and for control of red imported fire ants. The commercial use labeling bears directions for ground row crop application, ground orchard spraying, and aerial application. It should be noted that use in commercial aquatic plants is restricted to commercial facilities that utilize fully contained above or in-ground pools or containers for the purpose of commercial production of aquatic ornamental plants. The residential use labels for each product bear claims for control or suppression of lepidopterous larvae, dipterous leafminers, thrips, Colorado potato beetle, fruit flies, and red imported fire ants in home lawns, gardens, and ornamental plants. The residential use labeling recommends 0.6 fluid ounce of product per 10 gallons of water and directs the user to apply uniformly to plant foliage to point of runoff.

Dow AgroSciences LLC submitted efficacy and phytotoxicity data derived from GF-1640 WG-NC. The submitted data were developed in California, Arizona, Indiana, New Mexico, Washington, Pennsylvania, and New York. Spinetoram was tested against a wide range of pests including codling moth, leafminers, thrips, apple maggot, beet armyworm, cabbage looper, grape leaf skeletonizer, omnivorous leafroller, and plum curculio. The application rates and methods used were consistent with the use directions on the Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC labels. No signs of phytotoxicity were observed in any of the treated crops. DPR determined that when used as directed, spinetoram is not phytotoxic and is an effective insecticide for its labeled uses.

ALTERNATIVES

Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC are used for the control or suppression of many foliage-feeding pests including lepidopterous larvae, thrips, Colorado potato beetles, dipterous leafminers, and certain psyllids infesting a wide range of crops. The

active ingredient, spinetoram, is derived from the fermentation of *Saccharopolyspora spinosa*, a naturally occurring soil organism. Spinetoram does not have a significant impact on beneficial parasitic and predaceous arthropods in treated crops. Spinetoram has a low mammalian toxicity and a short worker restricted entry interval of 4 hours. Spinetoram is classified as a reduced risk pesticide by the U.S. EPA. Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC labels recommend use of the products as part of an integrated pest management (IPM) program. A number of other active ingredients are registered as broad-spectrum insecticides for use on fruits and vegetable crops. However, an effective integrated pest management strategy requires the flexibility of a large number of comparable, but not exactly equivalent, pesticides in order to reduce the development of resistance.

CONCLUSION

DPR evaluated the product labels and scientific data submitted to support the registrations of Spinetoram Technical, Delegate WG, GF-1640 WG-NC, Radiant SC, and GF-1587 SC-NC. The labels and data were found acceptable to support registration of all five products. The acute health risks to humans from exposure to spinetoram are minimal due to its low mammalian toxicity. The precautionary and first aid statements on the product label, and the recommended protective measures mitigate potential health risks to persons who may be exposed to these pesticides. If a risk assessment conducted by DPR determines that exposure to spinetoram may result in unacceptable margins of exposure, further restrictions will be placed on the use of spinetoram at that time. Dow AgroSciences LLC must provide DPR with revised labels for Delegate WG and Radiant SC removing references to use in micro-sprinkler systems at its next label printing.